Summary of AFTA/non-AFTA detection performance
Traditional training

- Preliminary EO assessment
- Traditional training (EO_01)
- Traditional training (EO_06)
- Traditional training (IR_01)
- Traditional training (IR_07)
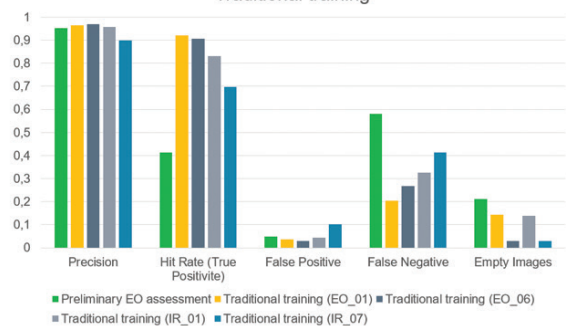
EO/IR_01: Maximum 100% real dataset
EO_06: 25% Real
IR_07: 15% Real

Summary of AFTA/non-AFTA detection performance
Trainsfer Learning – Feature Extraction
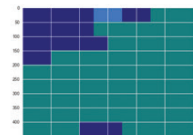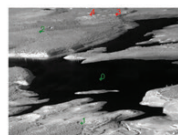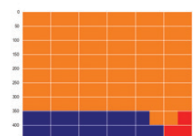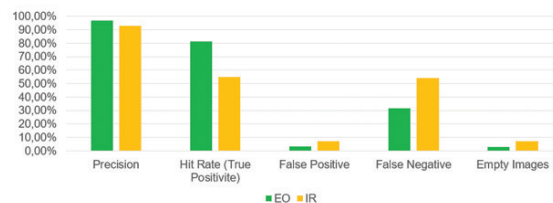
- EO
- IR

SAFETERM

Developed by:

gmv INNOVATING SOLUTIONS
www.gmv.com

AERTEC
https://aertecsolutions.com/

Project funded by:

EUROPEAN DEFENCE AGENCY
https://eda.europa.eu/

http://www.safeterm.eu/

SAFETERM
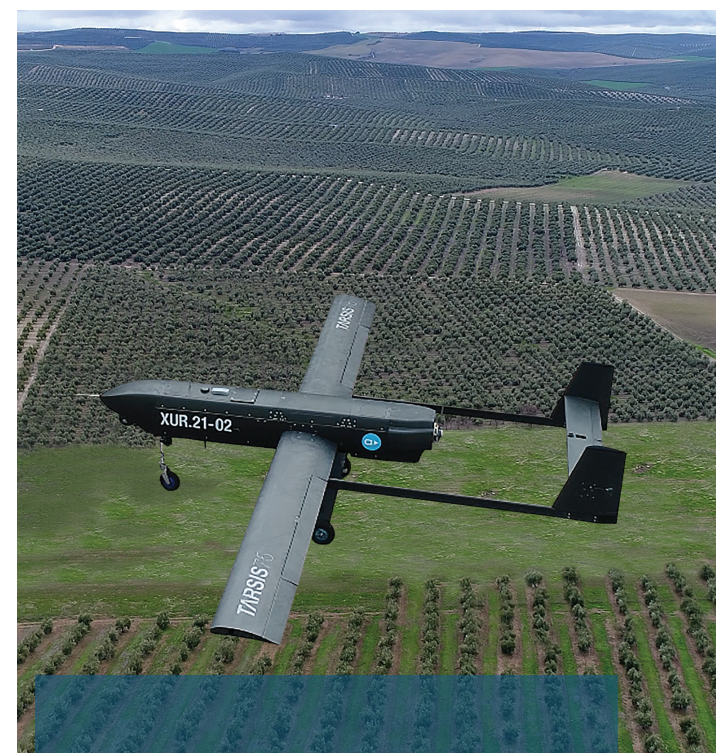

Safe Termination System (SAFETERM)

MOTIVATION

The **SAFETERM** system is based on Artificial Intelligence and Computer Vision. Its main objective is to enhance current flight termination systems and procedures for RPAS in emergency situations leading to a flight termination into the terrain.

SAFETERM aims at a safe flight termination when it is not possible to follow the pre-preplanned emergency routes or control the aircraft by other means. Then it shall determine a suitable termination area in order to avoid personal or material loss.

SAFETERM is a Research and Development project that aims at supporting the production of standards and guidelines for embeddable Artificial Intelligence systems in avionics. To that end, **SAFETERM** consortium is collaborating closely with the joint standardisation group EUROCAE 114/SAE G34.

CONCEPT OF OPERATIONS

SAFETERM system works as a real time image classifier using an Artificial Intelligence algorithm **SAFETERM** activation process is depicted below:
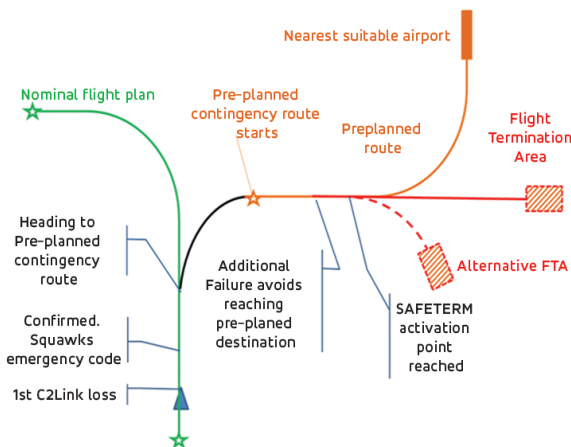
- Loss of C2link. The aircraft engages automatically the preplanned contingency route.
- Before or after suffering the Loss of C2link, the aircraft suffers another failure, preventing it from following the preplaned contingency route.
- **SAFETERM** system is launched at a defined activation height. The system shall start processing the images to find any Alternative Flight Termination Area.
- **SAFETERM** builds a list of potential flight termination areas, which is continuously updated.
- At a defined decision height, **SAFETERM** shall provide the final flight termination area coordinates. The navigation control will take actions to reach those coordinates.

## ARTIFICIAL INTELLIGENCE INSTANCE

The system uses a Convolutional Neural Network to recognize and classify the terrain. The system has been trained mixing synthetic and real data. State of the art image classification training techniques has been used. **SAFETERM** has been tested against carefully designed test datasets, which have been created under two criteria:

- Complete isolation from the training dataset.
- Enough complexity, completeness and representativeness.

Its size and variety is enough to test the generalisation capacity of the system. It is representative of the Operational Design Domain.

FLIGHT TEST CAMPAIGN RESULTS

The SAFETERM System was presented the 8th of June. During the previous days the Flight Test Campaigns where launched. In order to validate the integration of the embedded system into the TARSIS 75 RPAS.
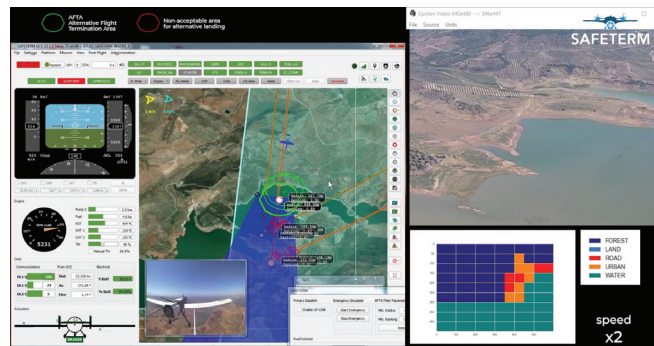
During the Test Flights, the system was linked to the Ground Control Station in order to show in real time the whole process. In the following image we can see how the RPAS, represented by the yellow airplane logo is heading towards the green area which is a suitable landing spot on the mass of water in front of it. This is the most suitable Alternative Flight Termination Area within the SAFETERM categorization. On the right of this view it is possible to see the heatmap corresponding to the current image displayed, which is the final product of the Machine Learning/ Artificial Intelligence Partition, categorizing in real time what is seen by the camera.

PROJECT ROADMAP

After two years of project development, the 8th of June of 2022 the system was tested on a real flight campaign.